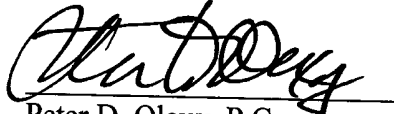


SUPPLEMENTAL AMENDMENT UNDER
37 C.F.R. § 1.111
U.S. Application No. 09/380,032

REMARKS

In line with the Amendment of the claims, the specification is amended to read
“magnetoplumbite[-type]”, type is deleted.

Respectfully submitted,



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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The specification is changed as follows:

Page 1, delete first full paragraph and insert the following paragraph:

The present invention relates to a high-performance ferrite magnet having substantially a magnetoplumbite-type crystal structure extremely useful for wide ranges of magnet applications such as rotors for automobiles or electric apparatuses, magnet rolls for photocopiers, etc., particularly to a high-performance ferrite magnet having a microstructure having a higher coercivity iH_c (or higher coercivity iH_c and residual magnetic flux density B_r) than those of the conventional ferrite magnets and optionally a high squareness ratio H_k/iH_c , and a method for producing such a high-performance ferrite magnet.

Page 4, delete second full paragraph and insert the following paragraph:

Next, as a result of investigation of a hexagonal magnetoplumbite-type sintered ferrite magnet described in Japanese Patent Laid-Open No. 9-115715, it has been found that higher iH_c cannot easily be achieved.

Page 4, delete last paragraph bridging pages 4/5 and insert the following paragraph:

The magnetism of the magnetoplumbite-type ferrite magnet is derived from a magnetic moment of Fe ions, with a magnetic structure of a ferri-magnet in which magnetic moment is arranged partially in antiparallel by Fe ion sites. There are two methods to improve the saturation magnetization in this magnetic structure. The first method is to replace the Fe ions at

sites corresponding to the antiparallel-oriented magnetic moment with another element, which has a smaller magnetic moment than Fe ions or is non-magnetic. The second method is to replace the Fe ions at sites corresponding to the parallel-oriented magnetic moment with another element having a larger magnetic moment than Fe ions.

Page 5, delete second full paragraph and insert the following paragraph:

With the above findings in mind, research has been conducted for the purpose of replacing Fe ions with various elements by adding various metal compounds such as metal oxides. As a result, it has been found that Mn, Co and Ni are elements remarkably improving magnetic properties. However, the mere addition of the above elements would not provide ferrite magnets with fully improved magnetic properties, because the replacement of Fe ions with other elements would destroy the balance of ion valance, resulting in the generation of undesirable phases. To avoid this phenomenon, ion sites of Sr and/or Ba should be replaced with other elements for the purpose of charge compensation. For this purpose, the addition of La, Nd, Pr, Ce, etc. is effective, resulting in magnetoplumbite-type ferrite magnets having high Br or high Br and coercivity.

Page 6, delete second full paragraph bridging pages 6/7 and insert the following paragraph:

Accordingly, an object of the present invention is to provide a high-performance ferrite magnet having substantially a magnetoplumbite-type crystal structure, which has higher coercivity iHc (or higher coercivity iHc and residual magnetic flux density Br) than those of

conventional ferrite magnets and also has high squareness ratio H_k/iH_c , thus useful in wide varieties of magnet applications such as rotors for automobiles and electric appliances, magnet rolls for photocopiers, etc., and a method for producing such a high-performance ferrite magnet.

Page 7 delete first full paragraph and insert the following paragraph:

Another object of the present invention is to provide a high-performance ferrite magnet having substantially a magnetoplumbite-type crystal structure, which has higher coercivity iH_c (or higher coercivity iH_c and residual magnetic flux density Br) and higher squareness ratio H_k/iH_c than those of conventional ferrite magnets, and also has a microstructure in which the concentration of an R element is high in crystal grain boundaries, and a method for producing such a high-performance ferrite magnet.

Page 7, delete second full paragraph and insert the following paragraph:

As a result of intense research in view of the above objects, the inventors have found that the addition of an R element and an M element by a post-addition method or a prior/post-addition method to ferrite having a basic composition represented by $(A_{1-x}R_x)O \cdot n[(Fe_{1-y}M_y)_2O_3]$, wherein A is Sr and/or Ba, R is at least one of rare earth elements including Y, and M is at least one element selected from the group consisting of Co, Mn, Ni and Zn can turn the ferrite to a higher-performance ferrite substantially having a magnetoplumbite-type crystal structure with a higher squareness ratio H_k/iH_c and a reduced variation of shrink ratio, while keeping good coercivity iH_c (or good coercivity iH_c and residual magnetic flux density Br). The present invention has been completed based upon this finding.

Pages 7/8, delete paragraph bridging pages 7 and 8 and insert the following paragraph:

Thus, the ferrite magnet according to the first embodiment of the present invention has a basic composition represented by the following general formula:

$(A_{1-x}R_x)O \cdot n[(Fe_{1-y}M_y)_2O_3]$ by atomic ratio,

wherein A is Sr and/or Ba, R is at least one of rare earth elements including Y, M is at least one element selected from the group consisting of Co, Mn, Ni and Zn, and x, y and n are numbers meeting the following conditions:

$$0.01 \leq x \leq 0.4,$$

$$[x/(2.6n)] \leq y \leq [x/(1.6n)], \text{ and}$$

$$5 \leq n \leq 6,$$

and has a substantially magnetoplumbite-type crystal structure, the R element and/or the M element being added in the form of a compound at a pulverization step after calcination.

The ferrite magnet according to the second embodiment of the present invention has a basic composition represented by the following general formula:

$(A_{1-x}R_x)O \cdot n[(Fe_{1-y}M_y)_2O_3]$ by atomic ratio,

wherein A is Sr and/or Ba, R is at least one of rare earth elements including Y, M is at least one element selected from the group consisting of Co, Mn, Ni and Zn, and x, y and n are numbers meeting the following conditions:

$$0.01 \leq x \leq 0.4,$$

$$[x/(2.6n)] \leq y \leq [x/(1.6n)], \text{ and}$$

$$5 \leq n \leq 6,$$

and has a substantially magnetoplumbite-type crystal structure, the R element and/or the M element being added in the form of a compound both at a mixing step before calcination and at a pulverization step after calcination.

Page 8, delete first full paragraph and insert the following paragraph:

The ferrite magnet according to the second embodiment of the present invention has a basic composition represented by the following general formula:

$(A_{1-x}R_x)O \cdot n[(Fe_{1-y}M_y)_2O_3]$ by atomic ratio,

wherein A is Sr and/or Ba, R is at least one of rare earth elements including Y, M is at least one element selected from the group consisting of Co, Mn, Ni and Zn, and x, y and n are numbers meeting the following conditions:

$$0.01 \leq x \leq 0.4,$$

$$[x/(2.6n)] \leq y \leq [x/(1.6n)], \text{ and}$$

$$5 \leq n \leq 6,$$

and has a substantially magnetoplumbite-type crystal structure, the R element and/or the M element being added in the form of a compound both at a mixing step before calcination and at a pulverization step after calcination.

Pages 8/9, delete second paragraph bridging pages 8 and 9 and insert the following paragraph:

In both cases, the concentration of the R element is preferably higher in boundaries than in the magnetoplumbite-type crystal grains. When the R element is La and the M element is Co, the ferrite magnet has a residual magnetic flux density Br of 4,100 G or more, a coercivity iHc of 4,000 Oe or more and a squareness ratio Hk/iHc of 92.3% or more at 20°C. Also, when the R element is La and the M element is Co plus Mn and/or Zn, the ferrite magnet has a residual magnetic flux density Br of 4,200 G or more, a coercivity iHc of 3,000 Oe or more and a squareness ratio Hk/iHc of 93.5% or more at 20°C.

Page 9, delete first full paragraph and insert the following paragraph:

The method for producing a ferrite magnet according to the first embodiment of the present invention, the ferrite magnet having a basic composition represented by the following general formula:

$(A_{1-x}R_x)O \cdot n[(Fe_{1-y}M_y)_2O_3]$ by atomic ratio,

wherein A is Sr and/or Ba, R is at least one of rare earth elements including Y, M is at least one element selected from the group consisting of Co, Mn, Ni and Zn, and x, y and n are numbers meeting the following conditions:

$$0.01 \leq x \leq 0.4,$$

$$[x/(2.6n)] \leq y \leq [x/(1.6n)], \text{ and}$$

$$5 \leq n \leq 6,$$

and substantially having a magnetoplumbite-type crystal structure,

the method comprising the steps of uniformly mixing a compound of Sr and/or Ba with an iron compound; calcining the resultant mixture; adding the R element and/or the M element in the form of a compound to the resultant calcined powder at a pulverization step thereof; and sintering the resultant mixture.

Pages 9/10, delete last paragraph bridging pages 9 and 10 and insert the following paragraph:

The method for producing a ferrite magnet according to the second embodiment of the present invention, the ferrite magnet having a basic composition represented by the following general formula:

$(A_{1-x}R_x)O \cdot n[(Fe_{1-y}M_y)_2O_3]$ by atomic ratio,

wherein A is Sr and/or Ba, R is at least one of rare earth elements including Y, M is at least one element selected from the group consisting of Co, Mn, Ni and Zn, and x, y and n are numbers meeting the following conditions:

$$0.01 \leq x \leq 0.4,$$

$$[x/(2.6n)] \leq y \leq [x/(1.6n)], \text{ and}$$

$$5 \leq n \leq 6,$$

and substantially having a magnetoplumbite-type crystal structure,
the method comprising the steps of adding a compound of the R element and/or the M element at a percentage of more than 0 atomic % and 80 atomic % or less on an element basis at a step of uniformly mixing a compound of Sr and/or Ba with an iron compound; calcining the resultant uniform mixture; adding the remaining amount of the compound of the R element and/or the M element to the resultant calcined powder at a pulverization step thereof; and sintering the resultant mixture.

Page 19, delete second full paragraph and insert the following paragraph:

The ferrite magnet obtained by the post-addition method or prior/post-addition method of the present invention substantially has a magnetoplumbite-type crystal structure. When the R element is La and the M element is Co, the ferrite magnet has a residual magnetic flux density B_r of 4,100 G or more, a coercivity iH_c of 4,000 Oe or more and a squareness ratio H_k/iH_c of 92.3% or more at 20°C. Also, when the R element is La and the M element is Co plus Mn and/or Zn, the ferrite magnet has a residual magnetic flux density B_r of 4,200 G or more, a coercivity iH_c of 3,000 Oe or more and a squareness ratio H_k/iH_c of 93.5% or more at 20°C.

Page 20, delete first full paragraph and insert the following paragraph:

In the ferrite magnet of the present invention, the M element is sufficiently dissolved in the magnetoplumbite-type ferrite crystal grains, though the concentration of the M element tends to be higher in the crystal grain boundaries than in the crystal grains.

Pages 30/31, delete second full paragraph bridging pages 30 and 31 and insert the following paragraph:

Next, observation by a scanning-type electron microscope (SEM) was carried out on samples cut away in an appropriate size from sintered bodies prepared by adding La_2O_3 and CoO at a fine pulverization step. Table 2 shows the results of SEM analysis of magnetoplumbite-type ferrite crystal grains and crystal grain boundaries in these samples. It is clear from Table 2 that La (R element) and Co (M element) are fully dissolved in the magnetoplumbite-type ferrite crystal grains, though they also exist in crystal grain boundaries in large amounts. Further, analysis by SEM, etc. at 20 sites in each of the crystal grain boundaries and the crystal grains of this sample have revealed that La (R element) and/or Co (M element) tend to be higher in concentration in the crystal grain boundaries than in the magnetoplumbite-type ferrite crystal grains. This clearly has a close relation to the fact that the ferrite magnet was prepared by the post-addition method in which La_2O_3 and CoO were added for adjustment to the basic composition of the sintered body at the fine pulverization step after calcination.

Page 64, delete first full paragraph and insert the following paragraph:

Though the above EXAMPLES are related to Sr ferrite whose R and M elements are substituted, it should be noted that Ba ferrite and Sr-Ba ferrite, whose R and M elements are substituted, also substantially have a magnetoplumbite-type crystal structure showing higher coercivity iH_c (or higher coercivity iH_c and residual magnetic flux density B_r) than those of conventional ferrite magnets.

IN THE ABSTRACT OF DISCLOSURE:

The abstract is changed as follows:

A ferrite magnet having a basic composition represented by the following general formula: $(A_{1-x}R_x)O \cdot n[(Fe_{1-y}M_y)_2O_3]$ by atomic ratio, wherein A is Sr and/or Ba, R is at least one of rare earth elements including Y, M is at least one element selected from the group consisting of Co, Mn, Ni and Zn, and x, y and n are numbers meeting the conditions of $0.01 \leq x \leq 0.4$, $[x/(2.6n)] \leq y \leq [x/(1.6n)]$, and $5 \leq n \leq 6$, and substantially having a magnetoplumbite-type crystal structure, is obtained by uniformly mixing a compound of Sr and/or Ba with an iron compound; calcining the resultant uniform mixture; adding a compound of the R element and/or the M element to the resultant calcined powder at a pulverization step thereof; and sintering the resultant mixture. The compound of the R element and/or the M element may be added at a percentage of more than 0 atomic % and 80 atomic % or less, on an element basis, at a mixing step before calcination.